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Local Smoke-free Laws, QuitLine Call Rate, and Smoking Status in Kentucky

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Abstract

Purpose—The study investigated the relationships among local smoke-free public policies, county-level quitline call rate, and adult smoking status.

Design—A retrospective cross-sectional examination of demographic characteristics, smoking status of Kentuckians, and data from the Kentucky Tobacco Quitline were used to investigate the relationship of local smoke-free ordinances or Board of Health regulations together with county-level quitline use rates and population-level adult smoking status.

Setting—One hundred and four Kentucky counties.

Subjects—The sample was comprised of 14,184 Kentucky participants with complete demographic information collected from the 2009–2010 Behavioral Risk Factor Surveillance System.

Measures—Individual-level demographics and smoking status from the BRFSS; county-level urban/rural status; quitline rates; and smoke-free policy status.

Analysis—Given the hierarchical structure of the dataset, with BRFSS respondents nested within county, multilevel modeling was used to determine the predictors of smoking status.

Results—For every 1-unit increase in the county-level call rate the likelihood of current smoking status decreased by 9%. Compared to those living in communities without a policy, those in

communities with a smoke-free public policy were 18% less likely to be current smokers. Limitations include quitline call rate as the sole indicator of cessation demand, as well as the cross-sectional design.

Conclusion—Communities with smoke-free policies and higher rates of quitline use have lower rates of adult smoking.

Keywords

Tobacco; Quitline; Smoke-free Policies; Smoking

Indexing Keywords

Manuscript Format: Research; Research Purpose: Relationship Testing; Study Design: Non-experimental; Outcome Measure: Behavioral; Setting: State; Health focus: Smoking Control; Strategy: Policy; Target Population: Adults; Target Population Circumstances: education/income level; geographic location

Introduction

Comprehensive tobacco control policies contribute significantly to the decrease in prevalence of smoking and the subsequent health outcomes associated with smoking in the United States.¹ The Centers for Disease Control and Prevention suggests that enacting smoke-free public policies as well as implementing publicly-accessible telephone quitlines is necessary to significantly reduce smoking rates.¹ The Commonwealth of Kentucky ranks among the highest of all states in the nation in adult smoking prevalence (25.2%) and subsequently has the highest smoking-attributable mortality rate in the United States.² While strong evidence exists that individual tobacco control policies such as smoke-free legislation and quitline access influence smoking-related outcomes^{1,3–10}, no studies appear in the literature that have examined the impact of the combination of these two specific tobacco control policies on smoking-related outcomes. The purpose of this study was to investigate the relationships among local smoke-free public policies, county-level quitline call rate, and adult smoking status. The results will assist in understanding the impact of community-level tobacco control efforts, including smoke-free public policies and quitlines, on individual-level smoking status in a state with high smoking prevalence.

Methods

Design and Sample

The design is a retrospective cross-sectional study of Behavioral Risk Factor Surveillance System (BRFSS) 2009 and 2010 respondents from Kentucky. The sample is comprised of 14,184 participants with complete demographic information from 104 of the 120 Kentucky counties. Data from 16 counties were omitted from the analysis because the number of calls to the state quitline from these counties was too small to reliably estimate a call rate; 2,332 participants from the 104 counties were omitted because they were missing one or more demographic variables included in the analysis. BRFSS data from two years were combined

into one cross-sectional sample due to the limited number of respondents from small counties in a single year.

Measures

Demographics—The demographic characteristics of sex, race/ethnicity, age, marital status, employment status, and annual income were obtained for all 14,184 respondents. Given the low percentage of racial/ethnic minorities in the state, race was dichotomized to ‘White’ versus ‘Other’ since it was not possible to compare minority racial/ethnic groups separately. Age was recorded in years; marital status was coded as ‘Married’ versus ‘Other’; and respondents were classified as ‘Employed’ if they were employed for wages or self-employed. Income was coded as an ordinal variable with eight categories: 1=‘<\$10,000,’ 2=‘\$10,000 to <\$15,000,’ 3=‘\$15,000 to <\$20,000,’ 4=‘\$20,000 to <\$25,000,’ 5=‘\$25,000 to <\$35,000,’ 6=‘\$35,000 to <\$50,000,’ 7=‘\$50,000 to <\$75,000,’ and 8=‘ \$75,000.’

Smoking status—Participants were asked if they smoked cigarettes ‘every day,’ ‘some days,’ or ‘not at all.’ Those who responded that they smoked ‘every day or ‘some days’ and had smoked at least 100 cigarettes in their lifetime were classified as current smokers, while all others (including former smokers and never smokers) were categorized as nonsmokers.

Smoke-free policy status—Counties were coded as having a smoke-free ordinance or Board of Health regulation if at least one city in the county had implemented such a public policy. In Kentucky, most counties are relatively small with one large city (typically the county seat) where many find work and conduct business. The smoke-free policies typically cover the large city, but not the entire county. For the purposes of analysis, we typically consider the county smoke-free if at least one city in the county has implemented such a policy given that most residents are exposed to smoke-free conditions where they work and do business^{11–12}. Policy status for a particular county was determined as of the end of the calendar year (<http://www.mc.uky.edu/tobaccopolicy/Ordinances/SFLawsRegs%20Oct2011REV10-6-11.pdf>). Two counties were in the ‘policy’ group in 2010, but they had not yet implemented the smoke-free policy in 2009. The 2009 data for those two ‘policy’ counties were omitted from the analysis since they were collected before implementation, but the 2010 data from both were included in the analysis. Five other counties implemented smoke-free policies in 2009; these were included in the ‘policy’ group, and both years of BRFSS data were included in the analysis. Smoke-free policy status was coded as ‘1’ if the county had implemented an ordinance or Board of Health regulation during the time period included in the study and as ‘0’ if not.

Urban status of county—Urban/rural status of county was determined by Beale code (<http://www.ers.usda.gov/Data/RuralUrbanContinuumCodes/>). Counties with Beale codes of 1–3 were categorized as urban and those with codes from 4–9 were rural.

Quitline call rate—The county-level call rate per 1,000 adult smokers was determined for the 104 Kentucky counties with at least 10 calls to the Kentucky Tobacco Quitline between July 1, 2009 and June 30, 2010. The call rate was calculated for each county by dividing the number of calls by the number of adult smokers in the county and multiplying this ratio by

1,000. Number of adult smokers was estimated by multiplying the rate of adult smoking by the number of adults aged 18 and over. The call rates were based on a total of 4,280 eligible callers to the quitline during this time period; the 792 other quitline calls received during this time were classified as ineligible and omitted from the estimation of county-level call rates because they: (a) did not name their county of residence; (b) lived out of state; (c) lived in one of the 16 counties omitted from the analysis; or (d) were under age 18.

Data Analysis

All BRFSS data were analyzed using methods appropriate for survey data in SAS, taking into account the sampling scheme and data weights. The SURVEYFREQ and SURVEYMEANS procedures were used to obtain weighted prevalence estimates for demographic characteristics and current smoking and to compare these characteristics between those with and without a smoke-free public policy in their county of residence. Comparisons of categorical variables were conducted using the Rao-Scott chi-square test. Age and income were compared between groups using the two-sample t-test for weighted observations.

Given the hierarchical structure of the dataset, with BRFSS respondents nested within county, multilevel modeling to determine the predictors of the binary outcome of smoking status was done using the procedure GLIMMIX in SAS. This type of model allows for the inclusion of both individual- and county-level attributes and provides more accurate tests of significance, since ignoring the clustering of subjects within counties would incur bias in both the parameter estimates and their standard errors¹³. The GLIMMIX model developed to assess whether individual- and county-level characteristics predicted smoking was weighted using the BRFSS weights. Individual-level variables included in the model were sex, race/ethnicity, age, marital status, employment status, and income. County-level variables in the regression were urban/rural status, call rate per 1,000 adult smokers, and an indicator variable for smoke-free policy status. In addition, county was included in the model as a class variable to account for county-level differences that may influence smoking but were not explicitly included as predictors. An alpha level of .05 was used for all inferential analysis.

Results

Of the 104 counties included in the analysis, 23 (22%) had a smoke-free public policy. The urban/rural distribution of the counties was such that 31 (30%) were urban and most were rural. As shown in Table 1, there were population demographic differences between those living in counties with a smoke-free public policy and those whose county did not have such a policy. While there was no difference between these two subgroups of counties in weighted sex distribution of the BRFSS participants, those living in counties with a smoke-free policy were more likely to be minority. Those in counties with smoke-free policies were also more likely to be employed and less likely to be a current smoker, but the two groups of BRFSS participants did not differ on likelihood of being married. There was no significant difference in age between those living in a county with a smoke-free policy and those who did not ($t = 1.7$, $p = .1$); the average weighted age of all BRFSS respondents was 46.9 ($SD =$

29.7). Respondents living in a county with a smoke-free policy had a higher mean income than those who did not ($t = 9.7, p < .0001$).

The results of the weighted multilevel logistic model suggested that sex, race/ethnicity, age, marital status, employment status, income, quitline call rate and smoke-free policy status were all significant predictors of smoking status (Table 2). BRFSS participants who were male and white were more likely to be current smokers, while those who were older, married, employed and had higher incomes were less likely to be smokers. There was no difference in the model between urban and rural location, controlling for individual-level characteristics. Quitline call rate was predictive of lower likelihood of smoking. For every 1-unit increase in the county-level call rate, the likelihood of being a current smoker decreased by 9%. The average call rate across the 104 counties was 4.3 calls per 1,000 adult smokers. This observed odds ratio would suggest that compared to an adult living in a county with a call rate of 4.3, someone living in a county with a call rate of 5.3 would be 9% less likely to be a current smoker. Compared to those living in counties without a smoke-free policy, those in counties with a smoke-free public policy were 18% less likely to be current smokers. These odds ratios indicate the individual contributions of call rate and smoke-free policy status; the interaction between these two predictors was not significant.

Discussion

As demonstrated by several review studies, there is no doubt that quitlines and smoke-free legislation are effective population-based cessation interventions^{1,3–10,14}. What has not been as clearly demonstrated is how the effects of both the implementation of smoke-free public policies and quitline utilization influence the likelihood of smoking. The results of this study demonstrate that adults living in communities that have enacted smoke-free policies and exhibit higher quitline use rates have lower likelihood of smoking than those living in communities without these policies and with lower quitline call rates. While the current study's results are not surprising, our findings document the effect of two population-based tobacco control strategies on smoking status using multilevel modeling. The strength of the multilevel model used to assess predictors of smoking status is that not only were individual- and county-level variables included, but even when adjusting for personal and county-level demographic differences, the difference in the likelihood of smoking between those protected by smoke-free policies and greater state quitline use rates and those without these public policies and less frequent use of the quitline was significant. Those in counties with smoke-free public policies were 18% less likely to be current smokers. This finding is consistent with a recent review that highlighted reduced smoking prevalence, cigarette consumption, and improved cessation outcomes following the implementation of smoke-free public policies.⁴

Our analysis also found that individuals living in counties with a smoke-free public policy were more likely to be minority, employed, and have higher incomes. These findings are consistent with reviews documenting that the impact of smoke-free public policies vary by SES, age, gender, and race/ethnicity^{3,15}. For example, Tauras documents that racial/ethnic minorities are more responsive to changes in cigarette excise tax laws, and white youth are more responsive to changes in smoke-free public policies. The fact that individuals living in

smoke-free communities were more likely to be minority may have had more to do with the fact that many of these communities were in urban areas with a higher proportion of minority residents. Further, Hahn postulates that variations in smoke-free legislation outcomes by demographics may not be due to simply enacting a smoke-free policy, but may have more to do with how well the policy is implemented and enforced³. Given the limited research in this area, further study is needed to understand the differential impact of SES and ethnicity on the adoption and outcomes of tobacco control public policies.

One study limitation was that quitline caller records were de-identified prior to receiving the data set, making it impossible to determine whether smokers had called the quitline multiple times; this concern is somewhat mitigated due to the relatively short timeframe used to estimate county-level quitline rates (July 2009–June 2010). In addition, due to the cross-sectional design, the current study was unable to demonstrate cause and effect. It would not be unreasonable to suspect that the lower likelihood of smoking found among communities with smoke-free public policies may be due, in part, to access to tobacco treatment services and other tobacco control programs, such as media campaigns and school-based programs. However, this premise would need to be tested using a longitudinal study design. Future prospective studies that examine cessation-demand characteristics are needed to support the association of smoke-free public policies and quitline call rate with smoking status, and to assess the interaction between public policies and call rates.

So What?

What is already known on this topic?

Considered individually, both smoke-free public policies and quitlines have been shown to be associated with decreased smoking initiation and/or decreased smoking rates.

What does this article add?

Adults living in communities that enact smoke-free policies **AND** exhibit higher quitline use rates have lower smoking likelihood, compared to those living in communities without these policies and with lower quitline call rates.

What are the implications for health promotion practice or research?

A combination of smoke-free public policies and access to a cessation quitline has the potential to have a significant impact on public health by reducing adult smoking prevalence.

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Table 1

Weighted frequencies for the categorical demographic characteristics of BRFSS respondents and comparisons by whether county of residence has a smoke-free public policy ($N = 14,148$).

Demographic factor	County of residence has a smoke-free policy ($n = 5,907$)	County of residence does not have a smoke-free policy ($n = 8,241$)	Rao-Scott χ^2 (p-value)
Sex			
Percent of adults who are male	48.0	49.4	0.8 (.4)
Race/ethnicity			
Percent of adults who indicated race as white	87.6	96.1	103.2 (<.0001)
Marital status			
Percent of adults who are married	66.1	68.2	2.0 (.2)
Employment status			
Percent of adults employed for wages or self-employed	56.7	53.7	4.3 (.04)
Smoking status			
Percent of adults who are current smokers	23.0	27.4	10.0 (.002)

Table 2Weighted multilevel logistic regression with current smoking status as the outcome ($N = 14,148$)

Variable	Regression coefficient	Odds ratio (OR)	95% confidence interval for OR
Male	0.16**	1.17	(1.16 – 1.18)
White	0.07**	1.08	(1.06 – 1.09)
Age	−0.03**	0.98	(0.98 – 0.98)
Married	−0.45**	0.64	(0.64 – 0.65)
Employed	−0.02**	0.98	(0.97 – 0.98)
Income	−0.21**	0.81	(0.81 – 0.81)
Urban location	0.02	1.02	(0.86 – 1.20)
County call rate to QuitLine	−0.09**	0.91	(0.90 – 0.93)
Smoke-free policy in county of residence	−0.20*	0.82	(0.68 – 0.98)

Notes: a) indicator variables for county were included in the regression and b) the apparent zero-width confidence interval for age and income is due to rounding.

*
p .05;

**
p .0001